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Evidences of a Differential Death Rate of the Sexes Among Animals.

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I.—INTRODUCTION.

It has long been known by actuaries and statisticians that in the human species the death-rate of males is greater than that of females. This is true not only for deaths occurring after birth, but also for prenatal deaths.

Long before the time of DARWIN (1871) attention had been called to the fact that males greatly outnumbered females in stillbirths. An overwhelming mass of statistical data gives evidence of this phenomenon. Thus, (to cite some older and some newer work) it may be noted that for the decade 1865-1875 in the various countries of Europe, where reliable statistics are to be had on this point, the proportionate numbers of male stillbirths to female stillbirths was very high. In France, during this decade, the index-number for males was 144 (as compared with 100 for females) while in Italy, Belgium, Sweden, and Prussia, the index numbers were 140, 135, 133, and 129, respectively. In 1895 the index-number for males in Berlin was 137; in Hamburg, in 1896, it was 125. In fine, all available data on this point evidence this relation in the proportionate death-rates of the sexes before birth. It would appear rather clearly indicated that the unborn male human infant is less viable than the female.

The post-natal mortality of the males, also, is higher than

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that of the females. (DARWIN, 1871; PEARSON, 1897; NEWSHOLME, 1899; WEBB, 1911; YULE, 1911; WHIPPLE, 1919, *et al.)* To illustrate: in England and Wales during the period 1901-1905, the death-rate [1] for males was 53.8 *per M.* as compared with 44.9 *per M.* for the females. *These rates were calculated for the total population under five years of age.* In the urban districts the statistics showed death-rates for children under five years of 61.0 and 51.3 *per M.* for male and females, respectively. In the rural districts the corresponding death-rates were 40.1 and 32.2 *per M.* for males and females, respectively. In this body of data, only in the age-group of 5-15 years did the death-rate of females exceed that of males. (WEBB, 1911; *cf.* NEWSHOLME, 1899, p. 117.)

Bills of mortality from city boards of health and registry-offices in all civilized countries show a considerably greater expectation of life for women. (See, *e. g., Abridged Life Tables for States and Cities of the United States, 1920* (1922). The higher death-rate thus implied for adult males has generally been attributed to the "greater hardships and dangers" of a man's work. However, in such an attempted explanation the fact is lost sight of that this marked vital discrepancy between the adult sexes finds its counterpart in the diverse rates of infant mortality. TATHAM (1897) in his *English Life Table* shows that of 1,000,000 infants of each sex born, 161,-036 males and 131,126 females die in the first year (a death-rate for the males of 161.0 *per M.* as compared with 131.1 *per M.* for the females.) It will thus be seen that the males had a death-rate 122.8% of the female death-rate. For Germany, the *Statistisches Jahrbuch für das deutsche Reich, 1914,* (Bd. 35, pp. 30-31) in a general mortality table for the decade 1901-1910, gives data showing the same relation. The mortality *per M.* (exclusive of still-births) for infants under one year was 202.3 for males and 170.4 for females—a male death-rate 118.0% of that of the females. [2]

NEWSHOLME (1899, p. 125) has called attention to the fact that in infants under one year of age the rates of deaths due to debility, atrophy, and inanition show a differential death-rate of the sexes. (Males, 25.1 *per M.;* females, 20.3 *per M.* Such a differential death-rate in infancy cannot be explained

on the basis of "greater hardship and danger" of the males. It would seem, rather, to be due to a general lack of resistance, both to disease and to harmful environmental factors.

WHIPPLE (1919, p. 228) has stated the general facts for man in the following words:

> "In infancy the death-rate for males exceeds that for females by 20%. Between 5 and 25 years of age the differences vary considerably in successive years, but average about 10%. Above age 25 the male death-rate begins to exceed the female death-rate by considerable amounts, and this continues to the age of 40, when the excess is 35%. After that, it steadily decreases. In old age, the two rates are much alike."

II.—SEX-RATIOS AND DEATH-RATES IN FISHES.

In fishes, the proportions of the sexes are often reported as very unequal. This has been particularly true in recent years in reports on the *Poeciliidae*, or top-minnows. In other families of fishes, also, divergences from the typical, or approximately 1:1 ratio of the sexes in the higher animals have been noted. We are indebted largely to DARWIN (1871) and FULTON (1890, 1892, 1903) for what little we know of the sex-ratios of fishes.

The reasons for the paucity of literature on the sex-ratios of fishes is not far to seek. In sharp contrast with most mammals, among the lower vertebrates the sexes are indistinguishable at birth. Often a long period elapses before the young fish has developed secondary characters indicative of the sex of the individual. As a consequence the investigator of the sex-ratios of fishes has usually contented himself with study-in groups of adult fish. No account was taken of juvenile mortality. The connotation of the term "sex-ratio" then has been "sex-ratio of collection."

In nearly all reported sex-ratios of fishes the populations involved were not under experimental conditions. It is therefore clear that the ratios are complicated by unknown factors. Most of these ratios varied markedly from the "typical sex-ratio" in which the sexes are practically equal in number. Different habitats of the sexes, or differential migration to the spawning ground, or sex-peculiarities of behavior at the

time of spawning:—all these have been suggested in explanation of atypical sex-ratios found in catches of adult fish. If we disregard for a moment these factors, there are two alternative explanations that appear *a priori* most probable: *(a)* a possible differential death-rate of the sexes during the juvenile and adult period, and *(b)* an atypical distribution of sex-determining chromosomes during the maturation divisions of the germ-cells. As a result of such an unequal distribution of sex-chromosomes, a preponderance of one sex over another could be conceivably be produced.[3] For simplicity's sake we exclude here from consideration possible causation of atypical sex-ratios through the operation of a differential chance-of-fertilization of the two kinds of gametes in fertilization.

Cytological investigation of maturation-divisions of the germ-cells of bony fishes has failed to throw light on their chromosomal constitutions; genetic study of the Poeciliids *Aplocheilus latipes* (AIDA, 1921) and *Lebistes reticulatus* has, however, demonstrated them to be of the XX, XY type.[4]

A corollary of this finding would be the practical numerical equality of the sexes at birth (assuming no differential chance-of-fertilization or differential mortality of gametes.) This corollary has been established for a number of species of fishes: cytological examination of the gonads of litters of certain fishes *(Cymatogaster,* EIGENMANN, 1896; *Spinax,* PUNNETT, 1904; and *Gambusia,* GEISER, 1922) have shown the proportions of the sexes at birth to be practically equal. It remains to be ascertained whether in fishes as a group, the sexes are not nearly equal in numbers at birth, the atypical ratios later found being due to the operation of a differential death-rate.

While ransacking the voluminous literature of the fishes the present writer found recorded numerous data which appear to indicate in fishes a differential death-rate of the sexes similar to that found in man. As much of this evidence is published in out-of-the-way places, or in serials not readily accessible, it has seemed well to bring it together in a general paper. Together with this evidence for a differential mortality in the fishes, the writer has also found in the literature strong indications that the same thing holds for other animals,

e. g., crustacea, insects, and other mammals besides man. In the following pages the evidence for the existence of such a differential death-rate is presented.

a). THE PLAICE, *Pleuronectes platessa* L.

In the common plaice, which occurs abundantly over a wide distribution on the shores of western Europe, a considerable number of workers have gathered data which demonstrate the operation of a differential death-rate of the sexes. FULTON (1902, p. 356) first called attention to the fact that while in population taken as a whole, the sexes are practically equal (a conclusion drawn much more cogently from larger masses of data by HEFFORD, 1909, ATKINSON, 1908, *et al.*) nevertheless with older populations marked discrepancies from the typical sex-ratio occur, due to the "slower growth and earlier death of the males." PETERSEN, GARSTANG & KYLE (1907, Table LXVI) showed by age-frequency tabulations of German and English investigations (the condition of the otoliths being the criteria of age) that the proportions of males to females progressively decrease with age. WALLACE (1907) independently arrived at the same conclusion respecting the plaice of the southern North Sea. ATKINSON (1908) found the same general age-frequency relation in plaice from an unfished area, the Barents Sea, thereby disposing of the objection that this relation is due only to an "artificial" factor, *i. e.*, trawling and fishing in the North Sea. He concludes that "it is probable that the rapid diminution in numbers and final disappearance of males" in the age-groups is "accentuated by an earlier mortality of that sex." Thus, while in the 4511 young plaice which he measured and studied the males were nearly as numerous as the females (males, 47%; females, 53%) in the older fish 50-plus m. long the proportions were: male, 2-minus %; females, 98-plus %.

HEFFORD (1909, 1916) and WALLACE (1914) have shown with a large mass of carefully analyzed data the same relation. The work of HEFFORD (1909) is especially thoroughgoing, and its implications clear. This writer made a statistical analysis of the records of measurements of plaice caught in the period of 1903-1907 by the various international re-

search vessels, in order to ascertain to what extent seasonal variations occurred in the proportions of males and females caught in various parts of the North Sea. The total number of plaice studied was 179,118; of these, 89,945 were males and 89,173 were females. The percentages in the different length-groups (5-cm. increment) ranged from 55% males, 45% females, for the youngest fish, to 8% males, 92% females, for the oldest fish. WALLACE (1914, p. 79) showed for different areas that while for the average populations investigated in different areas of the North Sea during the year 1906-1909 the males were usually almost as abundant as the females (*ca.* 45% males), nevertheless, after the sixth, and particularly, the seventh, year of life, practically all the individuals were females (*ca.* 80%-100% females.)

b.) THE CANADIAN PLAICE, *Hippoglossoides platessoides* Fabr.

HUNTSMAN (1918) finds evidence to show in this fish that for the first two or three years of life there are more males than females, but that the older the fish become, the smaller is the relative numer of males, until finally, females alone are found among the oldest fish. In the Gulf of St. Lawrence, where there are fish of many different ages, he found the males more numerous than the females among the three-year-olds, but for the later years fewer and fewer males, until finally after an age of 14-24 years (with the single exception of the 21-year-old group) only females were found. He concludes that "there must surely be a higher death-rate among the females in early life, and among the males later, and this is not influenced by the temperature, as similar proportions of the two sexes for the various years of life are found both where there is rapid growth and early maturity in warm water, and also where there is slow growth and late maturity in cold water."

c). THE WITCH, *Pleuronectes cynoglossus* L.

FULTON (1904), p. 195) has called attention to the abundance of males among populations of young witches, while among the older populations the proportions were reversed.

Thus, among 2748 young, mostly 10 to 13 inches long, 915 were females and 1833 were males (66% males) while with a group of 422 fish 34 to 50-plus cm. long. 306 were females and 116 were males (27% males.)

d). THE SALMON, *Salmo salar* L.

MASTERMAN (1913) made a study of the salmon with especial reference to age-determination by study of the scales. He found that the male sex predominated numerically in the early years and (MASTERMAN, 1913a) that this predominance is lost in the higher age groups, and is replaced by that of the females.

MENZIES (1916) has also shown a lower percentage of males with increase in age. Thus, in a group of 1294 yearlings, the sex-ratio was 100 females to 71 males, while in a group of 347 two-year-olds, the ratio has been reduced to 100 females to 43 males. MENZIES' (1921) data also, though somewhat confusing, bear out his earlier conclusion. He found that in the salmon of Thurso Bay, about one-third of the total catch were males. The different age-groups, however, varied considerably. Thus, among the "grilse" (1-plus years) group the average percentage of males for the whole season was 57, while for the "small summer fish" (2-plus years) group there was an average percentage of males of only 21.

e). THE SMELT, *Osmerus eperalanus L.*

MASTERMAN (1913a) by the dissection and study of 217 fish ascertained that in this species the males predominated in numbers in early years: a predominance that is lost in the higher age-groups and is replaced by that of females. Thus, the oldest and largest fish were found to be females. From this he concluded that the probability of life is less in the male than in the female sex.

f). THE DOGFISH, *Spinax niger.*

PUNNETT (1904, p. 321) by the microscopical examination of the gonads of 308 dogfish embryos found the sexes to be approximately equal in numbers at birth. (This conclusion is strengthened by the fact that in the three different years—

1901-3—in which embryos were collected, the proportions of males to females were respectively 35:39, 48:46 and 66:74.) However, in adult populations, the females are very much in the majority, being twice as numerous as the males. He concluded, consequently, that the post-natal mortality is greater among the males than among the females—a conclusion which was pointed independently by a statistical treatment of the meristic variations.

PUNNETT'S study suggests that a differential death-rate of the sexes may be responsible for the low percentages of males found in certain rays, as reported by FULTON (1903.)

g.) THE TOP-MINNOW, *Gambusia holbrooki* Grd.

GEISER (1921) showed a greater death-rate among the males in shipments of top-minnows. This obtained in both cold weather and warm weather shipments. Thus, in cold weather the male death-rate was one and one-half times the female death-rate; in warm weather, it was two and one-half times the female death-rate. The same writer (GEISER, 1922) has also noted that the proportions of the sexes of this fish at birth are practically equal. Adult populations, on the other hand, show a great preponderance of females, thus indicating a higher male death-rate after birth. Further experimental studies yet unpublished, demonstrate a differential death-rate of the sexes when diverse harmful substances are added to the environment.

III.—EVIDENCES FROM OTHER GROUPS OF ANIMALS.

The writer has not been able to ransack the literature of other groups in a thoroughgoing fashion. There have, however, a number of pieces of work and observation appeared which appear to indicate unmistakably the operation of a lethal selection such as has been shown so well in the fishes. These will be briefly referred to in the subsequent paragraphs.

a.) *Mammals other than Man.* JEWELL (1921) in his study of foetal cattle found a differential death-rate of the sexes similar to that found in man, and in fishes.

b.) *Crustacea.* PUNNETT. (1904a) has noted that in the Shore-Crab, *Carcinus moenas*, the males are less viable than

the females. More recently BLEGVAD (1922) has shown in the Amphipod *Gammarus locusta*, and in the Schizopods *Mysis flexuosa*, *M. neglecta*, and *M. inermis*, the same sex relation.

c.) *Insecta.* Dr. ELEANOR CAROTHERS has found among Orthoptera that while the sexes are produced in practically equal proportions, the ratio of the sexes in adult populations often varies considerably, due to the lesser viability of the males. When the insects are attacked by disease or by fungus-infestation, they are the males who suffer most severely. PHIL & NELLIE RAU (1914) have also shown that in the Polyphemus moth, the male is much shorter-lived than the female. It is only fair to say, however, that they do not find this relation universal among the Lepidoptera. Thus, in the Cecropia moth, the male is found to live as long or even a little longer than the female. It has been suggested by entomologists, however, that a great many of the insects show a difference of longevity of the sexes, in favor of the female.

IV.—CONCLUSIONS.

From the foregoing, it appears conclusively to the writer that in many diverse groups of animals a lesser viability of the males is indicated. What this may be due to, remains to be ascertained by future investigation. It appears, however, that this differential death-rate cannot be due to deleterious influences in the environment to which the two sexes are unequally subjected, but is merely the expression of a greater stability, or survival-value, in the female of animals generally.

[1] *Average annual death-rates* for the 0-5 year perod.

[2] GLOVER in his *United States Life Tables* (U. S. Bur. Census, 1921) has in his Tables 75 and 76 given data on the differential mortality of the sexes during the first year of life in all countries registering births and deaths. His data show death-rates for males averaging 120% that of the females.

OCCAM'S RAZOR will exclude the suggestive hypothesis put forward by HUXLEY, in the December, 1920, number of the *Journal of Ecology* to account for reported abnormal sex-ratios in *Lebistes*, a poeciliid Teleost.

[4] These very conclusive demonstrations are to be found in a paper by SCHMIDT, 1920, in the *Comptes-Rendus des Travaux du Laboratoire Carlsberg*, 14me. volume, No. 8, and in the more extensive paper by TATUO AIDA, cited in the literature. Since this paper was written, WINGE (*Jour. Genetics, Vol.* XII., *No.* 2, *Oct.* 1922) has demonstrated cytologically the XX, Xy constitution of *Lebistes*, and greatly extended the genetical studies of SCHMIDT.)

[5] Personal communicaton from Miss CAROTHERS.

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An Amateur Wild Flower Bed.

O. A. STEVENS, FARGO, NORTH DAKOTA.

The present is a brief account not of what *can* be done with wild flowers, but of what *has* happened with just ordinary treatment and ordinary neglect. The work was begun in the spring of 1917. The space used is a trapezoid with one end oblique, 5½ feet wide, 12 and 9 feet long on the inner and outer sides respectively. It occupies a corner at the north end of an east porch, partially protected by the corner of the house and bounded on the outer side by a cement walk which goes to the side door.

The Fargo soil is a black alluvial clay which is very sticky when wet and becomes hard and lumpy when dry. The lighter colored subsoil is still more sticky and quite intractable where basement excavating has left it to form a part of the lawn or garden. The house had been rebuilt the preceding year, and the soil of the bed in question contained a small amount of subsoil in the surface and more or less debris of building. A few pieces of decaying wood brought from the woods were put in the ground at the start. Some years it has had a covering of leaves raked upon it in the fall, in others only what might naturally accumulate. Usually there is a good covering of snow during winter but the outer edge next to the walk is somewhat windswept. The plants have suffered more or less from children jumping off the porch rail upon them and from other natural accidents.

The plants will be enumerated under three heads: (1) Those intentionally introduced, (2) those unintentionally but artificially introduced, and (3) those naturally introduced. I have put off writing the account and neglected to keep notes in the meantime so that some of the details have been lost. The sharp angle at the front is occupied by a small *Spiraea* and a *Cornus sanguinea* was put at the other end against the house. The latter has not been very successful, as it grows too large for the space and is inclined to become scraggly and to droop over the bed. It is usually infested with aphids which attract warblers and vireos during their spring migrations.

Unless otherwise stated the plants have been brought from the nearby woods of the river. A few from the prairie were put in the outermost corner.

I. PLANTS INTENTIONALLY INTRODUCED.

1. *Matteucia struthiopteris.* OSTRICH FERN. This was the first plant introduced, three or four large crowns being brought from the woods before the frost was entirely out of the ground. Such good specimens were expected to produce handsome plants but no amount of watching could detect signs of growth. After some time plants appeared at one side of the old crowns. Gray's Manual states that "the underground stolons bear fronds the next year" but does not indicate the length of life of the crown. These stolons are peculiar, the scale of the node appearing as if a knife cut had been made about an inch long and midway through the stem. Two or three small plants transplanted the last of May showed little ill effect.

2. *Uvularia grandiflora.* LARGE BELLWORT. A large clump of this was transplanted the last of May when flowering was nearly past. It has done well and is a valuable addition to the collection.

3. *Uvularia sessilifolia.* SMALL BELLWORT. One lot of this was brought in but I believe the plants have not survived after the first year or two.

4. *Trillium cernuum.* NODDING WAKE ROBIN. These seem to have grown fairly well but have been in only a couple years.

5. *Erythronium albidum.* WHITE ADDER'S TONGUE. Bulbs from northeastern Kansas were planted in the fall of 1918. The plants have come up each spring but have not made a very good growth. No flowers have been produced.

6. *Vagnera stellata.* STAR-FLOWERED SOLOMON'S SEAL. This was brought in one spring but I do not remember whether it is alive yet or not.

7. *Anemone quinquefolia.* WIND FLOWER. Two attempts were made to transplant this but it has not become established.

8. *Aquilegia canadensis.* COLUMBINE. This was brought

in at the same time as the Large Bellwort and again by accident with the small ostrich ferns. Previous experience had shown that this plant takes kindly to the flower bed and is one of our most valuable wild flowers for cultivation. It can be depended upon to attract humming birds.

9. *Actaea rubra.* BANEBERRY. A large red fruited plant was moved in the fall and has grown well.

10. *Caulophyllum thalictroides.* BLUE COHOSH. This was introduced in spring and has been fairly successful. The flowers are inconspicuous but the meadow-rue like foliage is rather pretty and the peculiar blue seeds are interesting.

11. *Sanguinaria canadensis.* BLOODROOT. Two introductions in flowering stages, neither one successful. Fresh seeds were collected and sown in 1921 but no results are available at the present time. A nice bed of the plants used to be in front of the east porch of a house not far away.

12. *Sieversia ciliatum.* TORCH FLOWER. Some sods of this were brought from the prairie the first year and placed in the outermost corner. The plants grew fairly well the first two or three years, but later seem to be dying out.

13. *Lathyrus venosus.* BUSHY VETCH. One introduction by the roots. Did not establish itself. This should make a good plant for some places, but is rather coarse for a small bed. The flowers are quite large and are borne in large clusters.

14. *Viola rugulosa.* What shall this plant be called now that it is regarded as distinct from *V. canadensis?* Of all the native violets this is the only one which has survived under the conditions and it has been exceedingly successful, increasing to a considerable extent although occupying part of the most exposed side of the bed.

15. *Viola pubescens.* YELLOW VIOLET. Planted next to the preceding but did not survive.

16. *Viola papilionacea.* BLUE VIOLET. I was surprised to see that this also failed to appear the next year. It is possible that the edge of the bed was more exposed than usual that winter. Neither this nor the yellow one have had a second trial.

17. *Viola sororia.* HAIRY VIOLET. A few plants of this

also were brought in but failed to reappear the next season.

18. *Viola conspersa.* This grows only in the aspen woods in the edge of the trees just beyond the low wet openings. One good sized plant was transplanted in 1922 when in full flower and continued to blossom as if unaffected by the change. I believe that another plant had been brought in a previous year but did not survive or at least reappear the next season.

19. *Viola pedatifida.* PRAIRIE VIOLET. A number of plants of this handsome species were placed near the *Sieversia*, and like it have declined slowly, perhaps due to attempts to weed out some undesirable plants among them.

20. *Steironema ciliatum.* FRINGED LOOSESTRIFE. I have admired this flower ever since I first became acquainted with it. A good sod nearby a foot square was brought in early in the spring. When the stalks were about four inches high something broke them off and the plant seemed discouraged for the year, much to my disappointment. The next spring I was surprised to see it coming up a yard or more from the original place. However, it does not seem inclined to make a dense stand and so far has not been considered a weed. The past summer it was noticeable that all the stalks were in the outer half of the bed. It was originally planted next to the porch on account of its height.

21. *Hydrophyllum virginicum.* WATERLEAF. This handsome plant is one of our commonest woodland flowers. The illustration and description in "Wild Flowers of New York," and in "Nature's Garden," seem not to do justice to it, as the flowers are more often of a much deeper color, reminding one of *Geranium maculatum*. They do not last well, however, soon becoming rather ragged in appearance. My experience is that they are a failure as cut flowers as they seem to refuse to freshen. Two pieces of sode were brought in early spring. The plants have succeeded and have produced seedlings freely. Some came also by accident with Steironema.

22. *Lithospermum canescens.* HOARY PUCCOON. One plant of this was brought in during the flowering season. It was dug none too carefully as the root is deep. The top wilted

and new growth soon appeared but did not come the next year.

23. *Spiraea salicifolia.* MEADOW SWEET. A good sized piece of this was introduced in early spring, not in the bed but along the front of the porch. In its natural condition the little thickets of the plant seem quite pretty, but as a shrub it was not a success, due to the short life of the branches which gave it a ragged appearance most of the time. It was dug out after two or three years.

24. *Rosa blanda.* SMOOTH WILD ROSE. Whatever may be its proper name this is our common woodland rose of the eastern part of the state. It is tall and has practically no prickles on the upper branches although the new shoots from the roots are well covered with them. Two plants were transplanted in early spring to the front side of the porch. In spite of an attempt to dig them carefully the large roots came up with few branches and no dirt. The first year the bushes made very little growth, but did much better the second season. One of them has become entirely too tall, being now about seven feet high. Two new shoots from the roots have reached a height of seven feet the past summer. The bushes have not shown much inclination to spread from the roots until the past summer when new stems came up a yard or more from the original plants. The leaves have been infested badly with leaf miners, and this has detracted from the appearence of the plants.

II. PLANTS UNINTENTIONALLY INTRODUCED.

25. *Agropyron smithii.* WESTERN WHEATGRASS. This was in the *Sieversia* sods. The grass much resembles quack grass but is not so persistent in fields, although it often causes trouble among groves of trees. In the flower bed it began to spread to a considerable extent. The second attempt at removing it seemed to be successful, but it also may have been responsible for the decline of *Sieversia* and *Viola pedatifida.*

26. *Agropyron richardsoni.* BEARDED WHEATGRASS. A plant or two came in the same way as the preceding species.

27. *Carex sp.* SEDGE. An unidentified species, also with the *Sieversia.*

28. *Salomonia commutata.* SOLOMON'S SEAL. I do not remember for certain but believe this came with *Hydrophyllum.* One or two stalks have come up and persisted.

29. *Menispermum canadense.* MOONSEED. I think this was brought with the ostrict fern roots. If given more room it should make a good addition to such a collection.

30. *Thalictrum dioicum.* EARLY MEADOW RUE. This came with the *Spiraea.* It is worth growing if a suitable place is available.

31. *Thalictrum dasycarpum.* TALL MEADOW RUE. This came with the *Steironema.* It has thrived and keeps to its place next the porch.

32. *Anemone cylindrica.* COTTON WEED. This came in the *Sieversia* sods. It has persisted but has not made much growth nor proven of value.

33. *Ribes americanum.* WILD BLACK CURRANT. This apparently came with the ostrich fern. It has persisted but has not made very much growth so far.

34. *Vicia americana.* WILD VETCH. Introduced with the *Spirăea.* The plant is distinctly ornamental and worthy of consideration.

35. *Falcata comosa.* HOG PEANUT. Seeds of this were introduced with some woodland plant, probably *Hydrophyllum.* At first it seemed a valuable addition, as the foliage is pretty and the flowers somewhat ornamental. By the third year it had become so abundant that it quite overran the bed and the following season an attempt was made to eradicate it. The seeds are close to the surface and come up with the plant if it is pulled soon after it begins to grow. Reproduction has been at least chiefly from the subterranean fruits. The plants were much less numerous the past season and another year ought to complete its eradication, but it has required considerable time and labor. The leaves were used the past summer by a leaf cutter bee, those of no other species in the bed being cut so far as observed.

36. *Zizia aurea.* MEADOW PARSNIP. This came with the Large Bellwort and at once sprung up to such a height that

it overshadowed everything in its vicinity. It was dug out rather roughly and removed to a more exposed place at the northwest corner where it continues to grow but not with its original exuberance. To be "consistent" I should call this species "woodland meadow-parsnip." With us it grows abundantly in the woods or around their margins, in thickets and openings but not so much in the open away from the woods. *Zizia cordata* is a plant of the low places on the open prairie.

37. *Solidago serotina.* TALL SMOOTH GOLDENROD. This came perhaps with *Hydrophyllum.* It very soon attempted to take complete possession and was the first species to be taken to task for its pertinacity. The rootstocks were close to the surface and eradication was not difficult.

38. *Aster paniculatus.* TALL WHITE ASTER. This was a running mate of the preceding, but its roots were deeper and not easily pulled up. The plant is decidedly weedy in low ground in the fields.

III. PLANTS INTRODUCED BY NATURAL MEANS.

39 *Chaetochloa glauca.* YELLOW PIGEONGRASS. An occasional plant but it does not thrive under such conditions.

40. *Ulmus americana.* WHITE ELM. This may be called a weed of gardens and flower beds where the young plants spring up from seeds blown from trees of streets and yards.

41. *Kochia scoparia.* BURNING BUSH. Some of these came the past year probably from seeds scattered from plants with which the children were playing the preceding fall.

42. *Alsine media.* CHICKWEED. This makes itself quite at home as usual in shaded places.

43. *Bursa bursa-pastoris.* SHEPHERD'S PURSE. A few plants of this common weed.

44. *Potentilla monspeliensis.* ROUGH CINQUEFOIL. An occasional plant.

45. *Prunus virginiana.* CHOKECHERRY. One plant which probably came from seeds of fruits brought from the woods.

46. *Oxalis cymosa.* SMOOTH YELLOW SORREL. A few plants of this are usually present.

47. *Acer negundo.* BOX ELDER. This may be called one of the principal weeds of flower beds and backyard gardens. The trees have been planted extensively on account of their rapid growth. They seed freely and the young plants come up in great numbers in the nearby flower beds and gardens. The seedlings are produced more freely than those of the elm but are not so firmly rooted and more easily pulled out.

48. *Ambrosia trifida.* GIANT RAGWEED. KINGHEAD (in our region). An occasional plant.

49. *Plantago rugelii.* RUGEL'S PLANTAIN. An occasional plant.

50. *Bidens frondosa.* BEGGAR TICKS. Occasional.

51. *Arctium minus.* BURDOCK. One seeding appeared the past summer. I often have thought that this plant has an unusually effective method of seed dispersal. The hooked bracts cling with unsurpassed tenacity, allowing the akenes to be shaken out at intervals. The dense bristles between the akenes probably act as a preventative of too rapid shattering and the marked tendency of the heads to remain in bunches would have a similar effect. I have found my shoe strings to be a favorite riding place and this plant may have arrived thus. However, the weed is not infrequent about the streets and some other carrier may have been host to that particular seed.

52. *Lactuca scariola integrata.* PRICKLY LETTUCE. Occasional.

53. *Taraxacum officinale.* DANDELION. No weed list of our locality would be complete without this plant. It has been one of the less important in the flower bed, however.

Birds of Watertown, Wisconsin.

BY BROTHER ALPHONSUS, C. S. C.

My vacation in the summer of 1922 was spent at Watertown, Wisconsin, where I arrived on August 8th and remained until September 7th. This town of about nine thousand people is some forty miles southeast of Madison, the capital of the state. Watertown, which is situated in the fertile Rock River Valley, I found to be a favorable locality for bird study. In all I obtained ninety-one records, the largest number I have ever got at that particular season of the year. In fact, I doubt whether I have ever secured, even in Spring, more satisfactory results from my observations.

Starting out every afternoon at 1:15 p. m. and remaining until 5 p. m., I found this time of day equally as good for observation as the morning. In one respect I think the early afternoon was better than the morning, for then there was a clearer light in the tree-tops, which made it easier to see the warblers. My list of warblers for this season of the year, I think, was remarkably large—twenty in all.

I confined my observations chiefly to two places—a wood with undergrowth and a small stream bordered by willows. Both localities proved very fruitful, but the grove gave me most of the warblers. Among the rare spceies were the following: Lark Sparrow, Yellow-throated Vireo, Acadian Fly-catcher, Blue Gray Gnatcatcher, Prothonatory Warbler, Black-billed Cuckoo, Blue-winged Warbler, and Titlark. The Lark Sparrow I had not seen in Indiana for many years. The Yellow-throated Vireo is rare also in northern Indiana. The Acadian Fly-catcher, a species of this family that is seldom seen, was very common in the grove I visited in Wisconsin. The Blue Gray Gnatcatcher was observed on two days in different localities. The Prothonatory Warbler was observed once. The Black-billed Cuckoo was perhaps more abundant than the Yellow-billed. The Lincoln Sparrow, in small numbers, was seen on two days. The Blue-winged Warbler was also found twice. The Rusty Black-bird, always very rare, was located near the stream on two days. The Golden-winged Warbler and a small flock of Titlarks were seen once.

The following is my bird list obtained in Watertown, Wisconsin:

MONTH OF AUGUST, 1922.

August 8, 1922.

1. Bobolink.
2. Crow.
3. Flicker.
4. Goldfiinch.
5. Rose-breasted Grosbeak.
6. Blue Jay.
7. Kingfisher.
8. Kingbird.
9. Meadowlark.
10. White-breasted Nuthatch.
11. Baltimore Oriole.
12. Wood Pewee.
13. Robin.
14. Chipping Sparrow.
15. Field Sparrow.
16. Grasshopper Sparrow.
17. Savanna Sparrow.
18. Song Sparrow.
19. Vesper Sparrow.
20. Barn Swallow.
21. Chimney Swift.
22. Yellow Warbler.
23. Cedar Waxwing.
24. Hairy Woodpecker.
25. Red-headed Woodpecker.
26. House Wren.
27. Mourning Dove.
28. Indigo Bird.
29. Spotted Sandpiper.

August 9, 1922.

30. Killdeer.
31. Purple Martin.
32 Rough-winged Swallow.
33. Red-winged Blackbird.
34. Bronzed Grackle.

August 10, 1922.

35. Downy Woodpecker.
36. Little Green Heron.
37. Bluebird.
38. Catbird.

August 11, 1922.

39. Chickadee.
40. Cowbird.
41. Crested Flycatcher.
42. Red-eyed Vireo.
43. Towhee.
44. Phoebe.

August 12, 1922.

45. Brown Thrasher.

August 13, 1922.

46. Warbling Vireo.
47. Bank Swallow.
48. Lark Sparrow.

August 14, 1922.

49. Yellow-throated Vireo.

August 16, 1922.

50. Acadian Flycatcher.
51. Bob-white.
52. Canadian Warbler.

August 17, 1922.

53. Blackburnian Warbler.
54. Connecticut Warbler.
55. Black and White Warbler.
56. Tennessee Warbler.
57. Hummingbird.
58. Yellow-billed Cuckoo.
59. Maryland Yellowthroat.

August 18, 1922.

60. Red-shouldered Hawk.
61. Redstart.
62. Nighthawk.

August 19, 1922.

63. Pine Warbler.
64. Scarlet Tanager.

August 20, 1922.

65. Adler Flycatcher.
66. Water Thrush.
67. Long-billed Marsh Wren.

August 21, 1922.
68. Blue Gray Gnatcatcher.

August 22, 1922.
69. Wilson Warbler.

August 23, 1922.
70. Black-throated Green Warbler.
71. Nashville Warbler.
72. Magnolia Warbler.

August 24, 1922.
73. Tufted Titmouse.

August 26, 1922.
74. Bittern.

August 27, 1922.
75. Prothonatory Warbler.
76. Least Flycatcher.

August 29, 1922.
77. Black-billed Cuckoo.
78. Oven-bird.

August 30, 1922.
79. Olive-backed Thrush.
80. Loggerhead Shrike.
81. Sparrow Hawk.

August 31, 1922.
82. Black-throated Blue Warbler.

MONTH OF SEPTEMBER, 1922.

September 1, 1922.
83. Blue-winged Warbler.

September 3, 1922.
84. Wood Thrush.
85. Lincoln Sparrow.
86. Rusty Blackbird.
87. Chestnut-sided Warbler.
88. Screech Owl.

September 5, 1922.
89. Golden-winged Warbler.

September 6, 1922.
90. Tree Swallow.
91. Titlark.